

15. Write an equation for the line tangent to the graph of $f(x) = 3x^2 - 4x + 2$ at $x = -1$.

$$f(-1) = 3(-1)^2 - 4(-1) + 2 = 3 + 4 + 2 = 9 \quad (-1, 9)$$

$$f'(x) = 6x - 4 \quad f'(-1) = 6(-1) - 4 = -10$$

$$y - 9 = -10(x + 1)$$

16. Write an equation for the line tangent to the graph of $f(x) = x^3(x-3)^2$ at $x = 2$.

$$f(2) = 2^3(2-3)^2 = 8 \quad (2, 8)$$

$$f'(x) = 3x^2(x-3)^2 + x^3(2(x-3))$$

$$f'(2) = 3(2)^2(2-3)^2 + 2^3(2(2-3))$$

$$= 12 + 8(-2)$$

$$= 12 - 16$$

$$= -4$$

$$y - 8 = -4(x - 2)$$

17. Write an equation for the line normal to the graph of $f(x) = \frac{\sqrt{x}+1}{\sqrt{x}-1}$ at $x = 9$.

$$f(9) = \frac{\sqrt{9}+1}{\sqrt{9}-1} = \frac{3+1}{3-1} = \frac{4}{2} = 2 \quad (2, 9)$$

$$f'(x) = \frac{(\sqrt{x}-1)(\frac{1}{2}x^{-\frac{1}{2}}) - (\sqrt{x}+1)(\frac{1}{2}x^{-\frac{1}{2}})}{(\sqrt{x}-1)^2}$$

$$= \frac{(\sqrt{x}-1)\frac{1}{2\sqrt{x}} - (\sqrt{x}+1)\frac{1}{2\sqrt{x}}}{(\sqrt{x}-1)^2}$$

$$f'(9) = \frac{(\sqrt{9}-1)\frac{1}{2\sqrt{9}} - (\sqrt{9}+1)\frac{1}{2\sqrt{9}}}{(\sqrt{9}-1)^2} = \frac{2 \cdot \frac{1}{6} - 4 \cdot \frac{1}{6}}{4}$$

$$f'(9) = \frac{\frac{1}{3} - \frac{2}{3}}{4} = \frac{-\frac{1}{3} \cdot \frac{1}{4}}{1} = -\frac{1}{12} \quad y - 9 = 12(x - 2)$$